U.S. FISH AND WILDLIFE SERVICE
SPECIES ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM

SCIENTIFIC NAME: *Ptychobranchus subtentum*

COMMON NAME: fluted kidneyshell

LEAD REGION: 4

INFORMATION CURRENT AS OF: March 2010

STATUS/ACTION*:*
___ Species assessment - determined species did not meet the definition of endangered or threatened under the Act and, therefore, was not elevated to Candidate status
___ New candidate
_X_ Continuing candidate
___ Non-petitioned
_X_ Petitioned - Date petition received: May 11, 2004
__ 90-day positive - FR date:
__ 12-month warranted but precluded - FR date:
__ Did the petition request a reclassification of a listed species?
FOR PETITIONED CANDIDATE SPECIES:
a. Is listing warranted (if yes, see summary of threats below)? yes
b. To date, has publication of a proposal to list been precluded by other higher priority listing actions? yes
c. If the answer to a. and b. is "yes", provide an explanation of why the action is precluded. Higher priority listing actions, including court-approved settlements, court-ordered and statutory deadlines for petition findings and listing determinations, emergency listing determinations, and responses to litigation, continue to preclude the proposed and final listing rules for the species. We continue to monitor populations and will change its status or implement an emergency listing if necessary. The "Progress on Revising the Lists" section of the current CNOR (*http://endangered.fws.gov/*) provides information on listing actions taken during the last 12 months.

___ Listing priority change
Former LP: ___
New LP: ___
Date when the species first became a Candidate (October 25, 1999):
___ Candidate removal: Former LP: ___
___ A – Taxon is more abundant or widespread than previously believed or not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status.
___U – Taxon not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status due, in part or totally, to conservation efforts that remove or reduce the threats to the species.
___ F – Range is no longer a U.S. territory.

___ I – Insufficient information exists on biological vulnerability and threats to support listing.
___ M – Taxon mistakenly included in past notice of review.
___ N – Taxon does not meet the Act's definition of "species."
___ X – Taxon believed to be extinct.

ANIMAL/PLANT GROUP AND FAMILY: Clams

HISTORICAL STATES/TERRITORIES/COUNTRIES OF OCCURRENCE: Alabama, Kentucky, Tennessee, Virginia

CURRENT STATES/ COUNTIES/TERRITORIES/COUNTRIES OF OCCURRENCE: Kentucky, Tennessee, Virginia

LAND OWNERSHIP
The fluted kidneyshell occurs in streams that generally run through private lands. A small percentage (~5 percent) of its current range occurs on federal lands in the upper Cumberland River system. This includes U.S. Forest Service lands (i.e., Horse Lick Creek, Rock Creek, Little South Fork) in Kentucky, and National Park Service lands (i.e., Big South Fork) in Kentucky and Tennessee.

LEAD REGION CONTACT: Rob Tawes, 404/679-7142, robert_tawes@fws.gov

LEAD FIELD OFFICE CONTACT: Cookeville, Tennessee, Field Office, Stephanie Chance, 931/528-6481, extension 211, stephanie_chance@fws.gov

BIOLOGICAL INFORMATION:
The following description, biology, and life history of the fluted kidneyshell is taken from Parmalee and Bogan (1998, pp. 204-205) and others cited in their book "The Freshwater Mussels of Tennessee." The fluted kidneyshell is a relatively large mussel that reaches about 5 inches (13 centimeters) in length. The shape of the shell is roughly oval elongate, and the solid, relatively heavy valves are moderately inflated. A series of flutings (parallel ridges or grooves) characterizes the posterior slope of each valve. Shell texture is smooth and somewhat shiny in young specimens, becoming duller with age. Shell color is greenish yellow, becoming brownish with age, with several broken, wide green rays. Internally, the pseudocardinal teeth (raised, interlocking hinges used to stabilize opposing shell halves) are stumpy and triangular in shape. The lateral teeth are heavy. The color of the nacre (mother-of-pearl) is bluish-white to dull white with a wash of salmon in the older part of the shell (beak cavity).

Adult freshwater mussels are filter-feeders, siphoning (drawing in or expelling water) phytoplankton, diatoms, and other microorganisms from the water column. For their first several months juvenile mussels employ foot feeding (ingesting food through the sweeping motions of a ciliated foot), and are thus suspension feeders that feed on algae and detritus. Mussels tend to grow relatively rapidly for the first few years then slow appreciably at sexual maturity (when energy is being diverted from growth to reproductive activities). As a group, mussels are extremely long-lived, living from a few decades to a maximum of approximately 200 years.

Large, heavy-shelled riverine species tend to have longer life spans. No age specific information is available for the fluted kidneyshell. However, considering that it is a fairly large, heavy-shelled riverine species, it would seem probable that it is relatively long-lived. Specimens collected after a chemical spill in the Clinch River,Virginia, were thin-sectioned to determine age. The maximum age of these individuals was 55 years (Henley *et al.* 2002, p. 19).

Most mussels, including the fluted kidneyshell, have separate sexes. Males expel clouds of sperm into the water column, which are drawn in by females through their incurrent siphons. Fertilization takes place internally, and the resulting zygotes develop into specialized larvae termed glochidia inside the water tubes of her gills. The fluted kidneyshell, along with other members of its genus, is unique in that the marsupial (portion of a brooding female's gill which holds embryos and glochidia) portion of the outer gills are folded in a curtain-like fashion. The fluted kidneyshell is thought to have a late summer or early fall fertilization period with the glochidia incubating overwinter. The following spring or early summer, glochidia are released as conglutinates, which are similar to cold capsules or gelatinous containers with scores of glochidia contained within. Conglutinate masses often mimic food items of glochidial fish hosts. Glochidia must come into contact with a specific host fish(es) in order for their survival to be ensured. Without the proper host fish, the glochidia will perish.

Fluted kidneyshell conglutinates are shaped like insect larvae and have an adhesive end that sticks to silt-free stones on the stream bottom. Insect larvae are common food items of many stream fishes. The fluted kidneyshell's host fishes, which include the barcheek darter (*Etheostoma obeyense*), fantail darter (*Etheostoma flabellare*), rainbow darter (*Etheostoma caeruleum*), redline darter (*Etheostoma rufilineatum*) and banded sculpin (*Cottus carolinae*), are tricked into thinking that they have an easy meal of insect larvae when in fact they have infected themselves with mussel glochidia (Parmalee and Bogan 1998, p. 205).

After a few weeks parasitizing the host fish's gill tissues, newly-metamorphosed juveniles drop off to begin a free-living existence on the stream bottom. Unless they drop off in suitable habitat, they will die. Thus, the complex life history of the fluted kidneyshell and other mussels has many critical steps that may prevent successful reproduction and/or recruitment of juveniles to existing populations.

The fluted kidneyshell is primarily a small river to large creek species, inhabiting sand and gravel substrates in relatively shallow riffles and shoals with moderate to swift current (Parmalee and Bogan 1998, p. 205). In comparison to co-occurring species, the fluted Kidneyshell demonstrates strong habitat specificity. It is associated with faster flows and low substrate embeddedness (Ostby 2005).

Most studies of the distribution and population status of the fluted kidneyshell presented below were conducted after the early 1960s. Gordon and Layzer (1989), Winston and Neves (1997), and Parmalee and Bogan (1998, pp. 204-205) give most of the references for survey work in regional streams. We have obtained more current, unpublished distribution and status information from State Heritage Programs, agency biologists, and other knowledgeable individuals.

The fluted kidneyshell is a Cumberlandian Region mussel, meaning it is restricted to the Cumberland (in Kentucky and Tennessee) and Tennessee (in Alabama, Tennessee, and Virginia) River systems. Historically, this species occurred in the Cumberland River main stem from below Cumberland Falls in southeastern Kentucky downstream through the Tennessee portion of the river to the vicinity of the Kentucky-Tennessee State line. In the Tennessee River main stem it occurred from eastern to western Tennessee. Records are known from approximately 16 Cumberland River tributaries. Working downstream, these streams included Horse Lick Creek, Middle Fork Rockcastle River, Rockcastle River, Buck Creek, Rock Creek, Kennedy Creek, Little South Fork, Big South Fork, Pitman Creek, Otter Creek, Wolf River, West Fork Obey River, Obey River, Caney Fork, South Harpeth River, and West Fork Red River. In addition, it is known from 21 Tennessee River system tributaries, including the South Fork Powell River, Powell River, Indian Creek, Little River, Clinch River, Copper Creek, Big Moccasin Creek, North Fork Holston River, Middle Fork Holston River, South Fork Holston River, Holston River, Nolichucky River, West Prong Little Pigeon River, Little Tennessee River, Hiwassee River, Flint River, Limestone Creek, Elk River, Shoal Creek, Duck River, and Buffalo River (Gordon and Layzer 1989; Winston and Neves 1997; and Parmalee and Bogan 1998, pp. 204-205).

Populations of the fluted kidneyshell are generally considered extant (current) if live or fresh dead specimens have been collected since circa 1980. Currently, it is limited to six populations in the Cumberland River system and six populations in the Tennessee River system (where two or more stream populations occur contiguously with no barriers, such as impoundments or long reaches of unoccupied habitat, they are considered single population segments). Cumberland River system tributaries with extant populations include the Horse Lick Creek, Buck Creek, Rock Creek, Little South Fork, Wolf River, Town Branch, and West Fork Obey River. Presently, this species is also known in the Powell River, Indian Creek, Little River, Clinch River, Copper Creek, North Fork Holston River, and Middle Fork Holston River in the Tennessee River system. Population segments include the Wolf River and its tributary Town Branch in the Cumberland system, and Clinch River and Copper Creek (but not the other two upper Clinch tributaries, Indian Creek and Little River) in the Tennessee system. Other populations considered extant at the time this species was first considered for listing under the ESA (e.g., Middle Fork Rockcastle River, Kennedy Creek) are now extirpated (R.R. Cicerello, Kentucky State Nature Preserves Commission, retired, pers. comm. 2005). In addition, the population in the upper North Fork Holston River, though still large, has declined since circa 2000. The species has been reintroduced into three sites in the upper Duck River, Tennessee, and into two sites in the Nolichucky River, Tennessee, by Tennessee Wildlife Resource Agency (TWRA) biologists translocating adult individuals from the Clinch River. A total of 2,160 have been put into the Duck and 1,530 into the Nolichucky since 2004 (D. Hubbs, TWRA, unpublished data 2009). In 2008, the Kentucky Department of Fish and Wildlife Resources translocated 144 individuals from the Clinch River into the Big South Fork of the Cumberland River (D. Hubbs, TWRA, unpublished data 2009). The species has also been translocated from the Clinch River, Tennessee into the Little Tennessee River bypass reach below Calderwood Dam, Tennessee. Since 2007, a total of 365 individuals have been placed into the Little Tennessee River (Davis *et al.*, Tennessee Tech University, unpublished data 2009). The Virginia Department of Game and Inland Fisheries (VDGIF) has reintroduced 58 individuals into Indian Creek, a tributary to the Clinch River. They plan to release this species into the North Fork

Holston and Clinch Rivers in 2010. It is not known if these populations are recruiting and becoming self-sustaining. Extirpated from both the Cumberland and Tennessee River main stems, the fluted kidneyshell has also been eliminated from more than 60 percent of the total number of streams from which it was historically known. It may also have occurred historically in other poorly sampled or unsampled streams within its range.

During historical times, the fluted kidneyshell was fairly widespread and common in many Cumberlandian Region streams based on historical museum and literature record collections. However, its decline in certain streams may have begun before European colonization. The presence of the fluted kidneyshell in certain streams, particularly in the middle Tennessee River system, is known only by records from aboriginal "kitchen middens" (archeological records of mussels used as food from several hundred to several thousand years before present). The extirpation of this species from numerous streams within its historical range indicates that substantial population losses and range reductions have occurred.

The 12 extant populations (in addition to the two reintroduced populations) in the Cumberlandian Region generally represent small isolated occurrences. Only in the Clinch River is a population of the fluted kidneyshell known to be stable and viable, but in a relatively short reach of river primarily in the vicinity of the Tennessee-Virginia State line. Approximately 500 individuals were found in quantitative surveys of the Clinch River in 2004 (Ahlstedt *et al.* 2005, p. 18). Live adults and juveniles have been observed over the past 10 years in shoal habitats in the Clinch River, particularly at and above Cleveland Island, and many more fresh dead shells have been collected in muskrat middens along the shores in this vicinity. The VDGIF has observed a decline in the species at Cleveland Island on the Clinch River based on quantitative surveys conducted in 2002 and 2008 (N. Eckert, VDGIF, pers. comm. 2010). The fluted kidneyshell is common (found relatively easily in qualitative surveys) in Copper Creek between creek miles (mi) 24 and 30 (kilometers (km) 39 and 48) (S. Hanlon, Service, pers. comm. 2009). Petty *et al*. (2006; pp. 4, 36) found the species between Copper Creek mi 15 and 19 and reported evidence of reproduction and recruitment of the species at these locations. Otherwise, the species is rare and appears to be nearly extirpated from the remainder of the creek downstream of this aggregation where it was previously reported (Hanlon *et al.* in press; Petty *et al*. 2006). In 2008-9, 35 live individuals were found in the Powell River, indicating that the species is not extirpated from the Powell River (M. Johnson, Virginia Tech., pers. comm. 2010). A small but recruiting population occurs in the Wolf River, Tennessee, based on 2005-06 sampling (Moles *et al.* 2007, p. 79). This may be the best population remaining in the entire Cumberland River system. Small populations of this long-lived species may persist for decades despite total recruitment failure. Therefore, some of the extant populations may be functionally extirpated.

Population size data gathered during the past decade or two indicate that the fluted kidneyshell is rare (experienced collectors may find four or fewer specimens per site of occurrence) in nearly all extant populations, the Clinch River being one exception. The fluted kidneyshell is particularly imperiled in Kentucky. The vast reduction of the once sizable Little South Fork population since the late 1980s and the tenuous status of the other Cumberland River system populations put the species at risk of total extirpation from that river system. In addition, the populations in the Powell River (post-1980) and the Middle Fork (post-1995) and upper North Fork (post-2000) Holston Rivers in Virginia have declined in recent years based on recent survey

efforts (S.A. Ahlstedt, USGS retired, pers. comm. 2009; Ahlstedt *et al.* 2005, p. 9; Henley *et al.* 1999, p. 23; Jones and Neves 2007, p. 477), although the North Fork population continues to be considerable but reduced in range. Populations of the fluted kidneyshell are locally abundant in the North Fork Holston River (Dinkins 2010, p. 3-1; Ostby and Neves 2005, 2006a, and 2006b). However, declines in mussel community abundance in the North Fork Holston River have been in the form of many die-offs. The cause for the observed die-offs is unknown (Jones and Neves 2007, p. 479), but may be related to agricultural practices (S. Hanlon, Service, pers. comm. 2009).

In summary, current status information for most of the 12 populations deemed to be extant is available from recent periodic sampling efforts (sometimes annually) and other field studies, particularly in the upper Tennessee River system. Some populations in the Cumberland River system have had recent surveys as well (e.g., Little South Fork, Horse Lick Creek, Wolf River). Populations in Buck Creek, Little South Fork, Horse Lick Creek, Powell River, and North Fork Holston River have clearly declined over the past two decades. Based on recent information, the overall population of the fluted kidneyshell is declining rangewide. Few populations are considered viable (e.g., Wolf, Clinch, Little [tributary to the Clinch River], North Fork Holston Rivers). All other populations are of questionable viability, with some on the verge of extirpation (e.g., Powell River; Buck, Horse Lick, Indian Creeks). The newly reintroduced populations in the Nolichucky and Duck Rivers will hopefully begin to reverse the downward population trend of this species.

THREATS:

A. <u>The present or threatened destruction, modification, or curtailment of its habitat or range</u>.

The decline of the fluted kidneyshell in the Cumberlandian Region and other mussel species in the eastern United States is primarily the result of habitat loss and degradation. These losses have been well documented for more than 130 years. Chief among the causes of decline are impoundments, stream channel alterations, water pollution, and sedimentation (Williams *et al.* 1993, p. 7; Neves 1993, pp. 4-5; Neves *et al.* 1997, pp. 60-78). Specific information presented in this section on threats to the fluted kidneyshell and causes of its decline were gathered primarily from these published sources and other studies generally cited in their works, except where noted.

Impoundments result in the dramatic modification of riffle and shoal habitats and the resulting loss of mussel resources, especially in larger rivers. Impoundment impacts are most profound in riffle and shoal areas, which harbor the largest assemblages of mussel species, including the fluted kidneyshell. Dams interrupt most of a river's ecological processes by modifying flood pulses; controlling impounded water elevations; altering water flow, sediments, nutrients, energy inputs and outputs; increasing depth; decreasing habitat heterogeneity; and decreasing bottom stability due to subsequent sedimentation. The reproductive process of riverine mussels is generally disrupted by impoundments, making the fluted kidneyshell unable to successfully reproduce and recruit under reservoir conditions. In addition, dams can also seriously alter downstream water quality and riverine habitat and negatively impact tailwater mussel

populations. These changes include thermal alterations immediately below dams; changes in channel characteristics, habitat availability, and flow regime; daily discharge fluctuations; increased silt loads; and altered host fish communities. Coldwater releases from large non-navigational dams and scouring of the river bed from highly fluctuating, turbulent tailwater flows have also been implicated in the demise of mussel faunas.

Population losses due to impoundments have probably contributed more to the decline of the fluted kidneyshell and other Cumberlandian Region mussels than has any other single factor. The majority of the Tennessee and Cumberland River main stems and many of their largest tributaries are now impounded. For example, approximately 2,300 river mi (3,700 river km) (about 20 percent) of the Tennessee River and its tributaries with drainage areas of 25 square mi (65 square km) or greater were impounded by the Tennessee Valley Authority (TVA) by 1971 (TVA 1971, p. 5). The subsequent completion of additional major impoundments on tributary streams (e.g., Duck River in 1976, Little Tennessee River in 1979) significantly increased the total miles impounded behind the 36 major dams in the Tennessee River system. Approximately 90 percent of the 562-mi (904 km) length of the Cumberland River downstream of Cumberland Falls is either impounded (three locks and dams and Wolf Creek Dam) or otherwise adversely impacted by coldwater discharges from Wolf Creek Dam. Other major U.S. Army Corps of Engineers (Corps) impoundments on Cumberland River tributaries (e.g., Obey River, Caney Fork) have inundated over 100 mi (161 km) of riverine habitat for the fluted kidneyshell.

Instream gravel mining has also been implicated in the destruction of mussel populations. Negative impacts associated with gravel mining include stream channel modifications (e.g., altered habitat, disrupted flow patterns, sediment transport), water quality modifications (e.g., increased turbidity, reduced light penetration, increased temperature), macroinvertebrate population changes (e.g., elimination, habitat disruption, increased sedimentation), and changes in fish populations (e.g., impacts to spawning and nursery habitat, food web disruptions) (Kanehl and Lyons 1992, pp. 26-27). Gravel mining activities threaten the fluted kidneyshell population in Buck Creek, one of the few remaining populations of this species in the entire Cumberland River system.

Heavy metal-rich drainage from coal mining and associated sedimentation has adversely impacted upper Cumberland River system streams with diverse historical mussel faunas. Strip mining continues to threaten mussels in coal field drainages of the Cumberland Plateau, including streams harboring small fluted kidneyshell populations (e.g., Horse Lick Creek, Little South Fork, Powell River, Indian Creek). The low pH commonly associated with mine runoff can reduce glochidial encystment rates. Acid mine runoff, thus, may be having local impacts on recruitment of the fluted kidneyshell. Portions of the upper Tennessee River system are also influenced by coal mining activities. Powell River mussel populations were inversely correlated with coal fines in the substrate; when coal fines were present, decreased filtration times and increased movements were noted in laboratory-held mussels (Kitchel *et al.* 1981, p.25). In a quantitative study in the Powell River, a decline of federally listed mussels and the long-term decrease in overall species composition since about 1980 was attributed to general stream degradation due primarily to coal mining activities in the headwaters (Ahlstedt and Tuberville 1997, pp. 74-76). Coal mining activities are increasing in the upper Tennessee River system in southwest Virginia. Numerous gray-water and black-water spill events have been documented in

the Powell and Clinch River drainages over the past several years. Fluted kidneyshell and other mussel populations in the Clinch and Powell rivers are increasingly being threatened by this activity. There are populations of 16 federally listed mussels now occurring in these streams in addition to four candidate mussels.

Contaminants contained in point and non-point discharges can degrade water and substrate quality and adversely impact mussel populations. The effects are especially profound on juvenile mussels, which can readily ingest contaminants, and glochidia, which appear to be very sensitive to certain toxicants. Mussels are very intolerant of heavy metals, and even at low levels, certain heavy metals may inhibit glochidial attachment to fish hosts.

Sediment from the upper Clinch River was found to be toxic to juvenile mussels. Ahlstedt and Tuberville (1997, p. 75) surmised that the presence of toxins in the Clinch River "could explain some of the decline and lack of recruitment of mussels in the Virginia portion of the Clinch." Numerous streams have experienced mussel kills from toxic chemical spills and other causes (Neves 1987, pp. 7-8).

Siltation and general sedimentation runoff has been implicated in the decline of stream mussel populations. Sources of silt and sediment include poorly designed and executed timber harvesting operations and associated activities; complete clearing of riparian vegetation for agricultural, silvicultural, or other purposes; and those construction, mining, and other practices that allow exposed earth to enter streams. Specific impacts on mussels from silt and sediments include clogged gills thus reducing their feeding and respiratory efficiency, impaired reproductive activity, disrupted metabolic processes, reduced growth rates, substrate instability, and the physical smothering of mussels under a blanket of silt. Even a relatively thin layer of silt may preclude adhesive fluted kidneyshell conglutinates from attaching to stones (as suggested for another species of *Ptychobranchus*; see Hartfield and Hartfield 1996, p. 373). Thus, a critical stage in its life cycle is potentially disrupted if contact with a proper host fish is not made.

In summary, habitat loss and degradation represent significant threats to the fluted kidneyshell. Severe degradation from impoundments, sedimentation, instream gravel mining, and contaminants threaten the habitat and water quality on which the fluted kidneyshell depends. Contaminants associated with coal mining (metals, other dissolved solids), domestic sewage (bacteria, nutrients), and agriculture (fertilizers, pesticides, herbicides, and animal waste) cause degradation of water quality and habitats through increased acidity and conductivity, instream oxygen deficiencies, excess nutrification, and excessive algal growths. Furthermore, these threats faced by the fluted kidneyshell from sources of sedimentation and contaminants are imminent; the result of ongoing projects that are expected to continue indefinitely, therefore, perpetuating these impacts. As a result of the imminence of these threats, combined with the vulnerability of the remaining small populations to extirpation from natural and manmade threats, we have determined that the present or threatened destruction, modification, or curtailment of the fluted kidneyshell habitat and range represents a significant threat of high magnitude.

B. Overutilization for commercial, recreational, scientific, or educational purposes.

The fluted kidneyshell is not a commercially valuable species, but may be increasingly sought by collectors with its increasing rarity. Although scientific collecting is not thought to represent a significant threat, localized populations could become impacted and possibly extirpated by overcollecting, particularly if this activity is unregulated.

In summary, the fluted kidneyshell is not commercially utilized but might be increasingly sought for scientific or educational purposes as their rarity becomes known. Scientific collections will be controlled by the states through issuance of collection permits. We consider overutilization for commercial, recreational, scientific, or educational purposes to be a potential threat of low magnitude and imminence.

C. Disease or predation.

The occurrence of disease in mussels is virtually unknown. Several mussel dieoffs have been documented during the past 20 years (Neves 1987, pp. 8-11). Although the ultimate cause is unknown, some researchers believe that disease may be a factor. The recent declines in the mussel fauna, including the once abundant fluted kidneyshell population, in the Little South Fork in Kentucky show signs that it may have been at least partially attributed to disease (Warren and Haag 2005, p. 1394), but no definitive cause has been determined.

Predation on the fluted kidneyshell by muskrats represents a localized threat, as determined by Neves and Odum (1989) in the upper North Fork Holston River in Virginia. They concluded that muskrat predation could limit the recovery potential of endangered mussel species or contribute to the local extirpation of already depleted mussel populations. Although other mammals (e.g., raccoon, mink) occasionally feed on mussels, the threat is not significant.

In summary, disease is not considered to be a current threat to the fluted kidneyshell. Predation does occur, but it is considered to be a normal aspect of the species' population dynamics and is not considered to pose an imminent threat to the species.

D. The inadequacy of existing regulatory mechanisms.

The States of Alabama, Kentucky, Tennessee, and Virginia prohibit the taking of mussels for scientific purposes without a State collecting permit. However, enforcement of this permit requirement is difficult. Furthermore, State regulations do not generally protect mussels.

Existing authorities available to protect riverine ecosystems, such as the Clean Water Act (CWA), administered by the Environmental Protection Agency (EPA) and the Corps, provide little direct protection to the fluted kidneyshell. Non-point source pollution is not regulated and the Clean Water Act does not adequately protect the habitat from degradation caused by point source pollutants.

The fluted kidneyshell receives incidental protection under the Endangered Species Act of 1973, as amended (Act), due to the coexistence of other federally listed mussels in the same streams. However, this protection is specific to each species. Federal listing would provide additional protection for this species by (1) requiring federal endangered species permits to collect or

otherwise take this species and (2) requiring federal agencies to consult with the Service when projects they fund, authorize, or carry out may adversely affect the species.

In summary, population declines and degradation of habitat for the fluted kidneyshell are ongoing despite the protection afforded by State and federal laws and corresponding regulations. Despite these laws, sedimentation and nonpoint-source pollution continue to adversely affect the species. Because of the vulnerability of the small remaining populations of the fluted kidneyshell and the imminence of these threats, we find the inadequacy of existing regulatory mechanisms to be a significant threat of high magnitude.

E. Other natural or manmade factors affecting its continued existence.

The remaining populations of the fluted kidneyshell are generally small and geographically isolated. The patchy distribution pattern of populations in short river reaches makes them much more susceptible to extirpation from single catastrophic events, such as toxic chemical spills. Such a spill occurred in the upper Clinch River in 1998 killing fluted kidneyshell specimens, as well as thousands of specimens of other mussel species, including three federally listed species (Henley *et al.* 2002). Furthermore, this level of isolation makes natural repopulation of any extirpated population impossible.

Population isolation prohibits the natural interchange of genetic material between populations, and small population size reduces the reservoir of genetic diversity within populations, which can lead to inbreeding depression (Allendorf and Luikart 2007, pp. 117-146). It is likely that some populations of the fluted kidneyshell are below the effective population size (Soulé 1980, pp. 162-264; Allendorf and Luikart 2007, pp. 147-170) required to maintain long-term genetic and population viability.

The present distribution and status of the fluted kidneyshell in the upper Cumberland River system in Kentucky may provide an excellent example of the detrimental bottleneck effect resulting when the effective population size is not attained. A once large population of this species occurred throughout the upper Cumberland River main stem below Cumberland Falls and in several larger tributary systems. In this region there were no absolute barriers to genetic interchange among its sub-populations (and those of its host fishes) that occurred in various streams. With the completion of Wolf Creek Dam in the late 1960s, the main stem population was soon extirpated, and the remaining populations isolated by the filling of Cumberland Reservoir. Whereas small isolated tributary populations of imperiled short-lived species (e.g., most fishes) would have died out within a decade or so after impoundment, the long-lived fluted kidneyshell would potentially take decades to expire post-impoundment. Without the level of genetic interchange the species experienced historically (i.e., without the reservoir barrier), isolated populations may be slowly dying out. Even given the improbable absence of anthropogenic impacts, we may lose smaller isolated populations of the fluted kidneyshell to the devastating consequences of below-threshold effective population size. In reality, degradation of these isolated stream reaches resulting in ever decreasing patches of suitable habitat is contributing to the decline of the fluted kidneyshell.

Therefore, we have determined that the imminence of other natural and manmade factors, such

as small, isolated populations and low genetic diversity, combined with localized extinctions from intentional or accidental toxic chemical spills, habitat modification and progressive degradation by nonpoint-source pollutants, and natural catastrophic changes to their habitat through flood scour or drought, threaten remaining populations of the fluted kidneyshell, and we consider the magnitude of these threats to be high.

CONSERVATION MEASURES PLANNED OR IMPLEMENTED

The Service has implemented ecosystem management in conserving, restoring, and recovering federal trust species and their habitats nationwide. Shute *et al.* (1997, pp. 448-453) summarized the ecosystem approach to the management of imperiled aquatic resources, provided a literature review on the subject, and recommended a series of steps for developing and implementing an ecosystem management program. These include prioritizing riverine systems in need of protection, identifying and partnering with all potential agencies and organizations with watershed interests, prioritizing ecosystem threats, identifying strategies to minimize or eliminate threats, and educating ecosystem inhabitants and other stakeholders.

In December 2007, a Memorandum of Understanding (MOU) was executed by Regions III and IV of the United States Environmental Protection Agency, the Tennessee Department of Environment and Conservation, the Virginia Department of Environmental Quality, and the Virginia Department of Mines, Minerals, and Energy. This MOU establishes a working group for coordinating efforts among these parties to protect and restore the Clinch and Powell Rivers, and their fish and mussel faunas. Partnering with State and federal agencies and the coal industry, The Nature Conservancy (TNC) is addressing the complex issue of abandoned mine lands, which may continue to impact fluted kidneyshell populations, by working on the Coal Re-mining Initiative.

The Service has partnered with a legion of stakeholders to initiate several watershed-based riparian habitat restoration projects on streams having diverse aquatic faunas within the Cumberlandian Region. Streams that harbor extant populations of the fluted kidneyshell and are the focus of these riparian restoration efforts include Horse Lick Creek, Kentucky, and the upper Clinch River, Tennessee and Virginia. TNC has selected the upper Clinch River, which has more species at risk mussels and fishes than any other small watershed in North America (and the largest extant fluted kidneyshell population known), as one of eight critical watersheds nationwide for protecting aquatic biodiversity (Master *et al.* 1998).

TNC has designated the community-based projects on Horse Lick Creek and the Clinch River as bioreserves. By working closely with key partners (e.g., Resource Conservation and Development Councils, Natural Resources Conservation Service (NRCS), numerous other agencies and organizations), riparian habitat restoration activities conducted by the Service (Partners for Fish and Wildlife program) and TNC are proceeding in high-biodiversity watersheds in the Cumberlandian Region. Bioreserve field representatives work closely with landowners and other stakeholders to effect riparian and aquatic habitat restoration. On-the-ground efforts that have helped improve riverine habitat in Bioreserves and other watershed-based riparian restoration projects include reducing erosion by stabilizing streambanks and using no-till agricultural methods, controlling nutrient enrichment by carefully planning heavy livestock use areas, establishing buffer zones by erecting fencing and revegetating riparian areas,

developing alternative water supplies for livestock, and implementing voluntary Best Management Practices to control run-off for a variety of agricultural and construction activities. Programs administered by NRCS are becoming increasingly important tools used in addressing habitat concerns associated with impaired Cumberlandian Region streams.

Two new watershed-based habitat restoration projects with fluted kidneyshell records are just getting underway. These are located on Buck Creek, Kentucky, which has a current population of the fluted kidneyshell, and the Duck River, Tennessee, which historically had a population. The Service and partners have allocated ESA section 6 funds for a stress analysis on Buck Creek and a mussel survey (there are records for four federally listed mussels). The stress analysis determines the location, type, severity, and extent of non-point source impacts facing that stream. Designed to function as a foundation for a holistic riparian habitat restoration program, priority reaches of high-quality habitat can be restored once a stress analysis has been completed.

Water and stream habitat quality improvements have made it possible for mussel populations to expand in some river reaches and may lead to augmenting depleted or reintroducing extirpated mussel populations in other streams. Such improvements in habitat conditions have come to fruition in parts of the Cumberlandian Region through the concerted efforts of the TVA, EPA, and other federal agencies, State water resources and natural resources agencies, industry, municipalities, conservation organizations, and concerned citizens. For instance, TVA has modified water releases from several of its dams to improve water quality conditions in the tailwaters.

State and federal agencies and the scientific community have cooperatively developed mussel propagation and reintroduction techniques and conducted associated research that has facilitated the reintroduction of mussels into historical habitats. Reintroduction projects exist for the Tennessee River at Muscle Shoals, Alabama, a site that historically held more species of mussels than any other mussel bed in the world. A final rule to reintroduce 16 federally listed mussel species and one aquatic snail to the remaining habitat of the site below Wilson Dam and a final rule to reintroduce 15 freshwater mussels, one freshwater snail, and five fishes in the Lower French Broad and Holston rivers will allow for recovery activities in these areas (66 FR 32250-32264, 72 FR 52433-52461). Reintroduction of the fluted kidneyshell into some of these stream segments, where the species historically occurred, is becoming more of a reality due to these efforts.

Certain Cumberlandian Region streams with records of the fluted kidneyshell receive a level of State protection from being designated outstanding resource waters. These usually include those streams with federally listed species. The Big South Fork system in Tennessee and Kentucky is protected as the Big South Fork National River and Recreation Area by the National Park Service.

Public outreach and environmental education play a major role in our recovery and restoration programs, thus benefiting aquatic species such as the fluted kidneyshell. Working with the Service and various other federal agencies through a private company, the Tennessee Aquarium in Chattanooga, Tennessee, recently installed an imperiled streams exhibit featuring mussels. A

large series of brochures, posters, videos, and other materials on subjects such as mussels and fishes and stream restoration techniques have been developed for public dissemination.

The fluted kidneyshell historically occurred in Cumberlandian Region streams that drain four states and two Service regions: Region 4 (Alabama, Kentucky, and Tennessee) and Region 5 (Virginia). Endangered species biologists in Region 5 supported Region 4 in its efforts to elevate this species to candidate status. In addition, we have contacted resource managers with the U.S. Geological Survey, EPA, TVA, TNC, Natural Heritage Programs, and State fish and wildlife agencies in these States. These agencies and organizations also supported elevation of the fluted kidneyshell to candidate status.

We have not personally contacted private landowners. However, realizing the importance of riparian landowners, who are crucial to the success of aquatic ecosystem management (Neves *et al.* 1997, pp. 77-78), our partners, most notably TNC, have contacted landowners. TNC has worked closely with scores of cooperative riparian landowners in fluted kidneyshell streams (e.g., Clinch, Powell Rivers; Horse Lick, Buck Creeks) to restore riparian buffers and protect water and stream habitat quality. If listed, the fluted kidneyshell will become more of a focus organism in project watersheds. With our partners, we will seek an increasing involvement of private landowners to restore and protect habitats essential for this species' continued survival and recovery.

SUMMARY OF THREATS (including reasons for addition or removal from candidacy, if appropriate)
Primary threats that currently affect this species include various habitat and water quality degradation factors that include reservoir operations, mining activities, contaminants, sedimentation, and population fragmentation. We find that this species is warranted for listing throughout all its range, and, therefore, find that it is unnecessary to analyze whether it is threatened or endangered in a significant portion of its range.

RECOMMENDED CONSERVATION MEASURES
General conservation measures include habitat conservation and restoration, water quality improvements, developing propagation technology to augment extant and reintroduce extirpated populations, and public outreach.

LISTING PRIORITY

THREAT			
Magnitude	Immediacy	Taxonomy	Priority
High	**Imminent**	Monotypic genus	1
		Species	**2***
		Subspecies/population	3
	Non-imminent	Monotypic genus	4
		Species	5

		Subspecies/population	6
Moderate To Low	Imminent	Monotypic genus	7
		Species	8
		Subspecies/population	9
	Non-imminent	Monotypic genus	10
		Species	11
		Subspecies/population	12

Rationale for listing priority number:

Magnitude: The fluted kidneyshell is currently restricted to 12 populations, appears to be rapidly disappearing from most streams in the Cumberland River system, and is declining in some Tennessee River system streams as well. Transplants of adults have been conducted by the States of Kentucky and Tennessee to historical streams using Clinch River stock since 2004. All populations face serious threats to their continued existence. Current threats include impoundments, sedimentation, small population size, isolation of populations, gravel mining, municipal pollutants, agricultural run-off, nutrient enrichment, and coal processing pollution. Considering the significant restriction in range, decline in population size, and level of habitat degradation of the fluted kidneyshell, we consider these ongoing overall threats to be of high magnitude.

Imminence: Threats to the fluted kidneyshell discussed above could result in extinction of the species due to the exceptionally small numbers estimated at nearly all of the extant locations. Available information indicates that successful recruitment and viability is clearly occurring in only one population, and that most if not all other populations may not be viable. Although there are on-going attempts to alleviate some of these threats, there appear to be no populations without significant threats and many threats are without obvious or readily available solutions. Threats stemming from coal mining activities appear to be accelerating in some drainages with declining populations (e.g., Horse Lick Creek, Little South Fork, Powell River, Indian Creek), and ultimately threaten the substantial population in the Clinch River if continued. In addition, the once sizable population in the upper North Fork Holston River has become restricted in range since 2000, although still substantial. Because these threats are ongoing, they are imminent.

Yes Have you promptly reviewed all of the information received regarding the species for the purpose of determining whether emergency listing is needed?

Is Emergency Listing Warranted? **No**

While the species is facing imminent threats of high magnitude, the threats are chronic and ongoing. We know of no projects or other threats being proposed in the short term that would warrant emergency listing.

DESCRIPTION OF MONITORING
Although specific monitoring for the fluted kidneyshell generally does not take place, periodic field work occurs in most of the streams with extant populations of this species. This work is

conducted by several colleagues with whom the Service is in close contact through phone conversations, electronic messages, and regular meetings (at least once annually). The data is written up in grey literature reports or published in scientific journals. Several stream surveys have been conducted in recent years, many of which staff members have been directly involved with (e.g., assisting in field sampling, manuscript reviews, technical assistance) and/or will serve as authors of when they are published in the peer-reviewed literature. Intensive stream surveys over the past several years include Buck Creek, KY; Big South Fork, KY and TN; Wolf River, TN; North Fork Holston River, TN and VA; Indian Creek, VA; Copper Creek, VA. In addition, USGS and Virginia Polytechnic and State university (Virginia Tech) continue to conduct periodic (five year) quantitative sampling in the Clinch and Powell Rivers, VA and TN, the most recent year being 2008. Periodic quantitative sampling sites are being established in other streams (e.g., Big South Fork) with extirpated populations of this species. In this way, we keep track of the general status of a suite of imperiled mussels, both listed taxa and species of concern, in addition to the fluted kidneyshell.

COORDINATION WITH STATES

Indicate what information was sent during coordination with states: The most recent version of the Continuing Candidate Form was sent out to states while soliciting updated population status information on the fluted kidneyshell. This was done via email sent February 22, 2010.

Indicate which State(s) did not provide any information or comments: Kentucky

Contacts:

Alabama—Jeffrey T. Garner, Alabama Department of Conservation and Natural Resources, 350 County Road 275, Florence AL 35633; bleufer@aol.com; 256/767-7673

Kentucky—Monte McGregor, Kentucky Department of Fish and Wildlife Resources, 1 Sportsman Lane, Frankfort KY 40601; monte.mcgregor@ky.gov; 502/573-1462

Tennessee—Don W. Hubbs, Tennessee Wildlife Resources Agency, PO Box 70, Camden TN 38320; tnmussels@aol.com; 731/584-9032

Virginia—Michael J. Pinder, Virginia Department of Game and Inland Fisheries, 2206 South Main Street, Suite C, Blacksburg VA 24060; mike.pinder@dgif.virginia.gov; 540/961-8387

STATES THAT INCLUDE THE SPECIES IN THEIR WILDLIFE ACTION PLANS

Indicate which State(s) (within the range of the species) include the species in their WAPs: Alabama, Kentucky, Tennessee, Virginia

LITERATURE CITED:

Ahlstedt, S.A. 2009. Telephone interview. U.S. Geological Survey, Knoxville, Tennessee. Retired.

Ahlstedt, S.A., and J.M. Tuberville. 1997. Quantitative reassessment of the freshwater mussel fauna in the Clinch and Powell Rivers, Tennessee and Virginia. Pp. 72-97 *in*: K.S. Cummings, A.C. Buchanan, C.A. Mayer, and T.J. Naimo, eds. Conservation and management of freshwater mussels II: initiatives for the future. Proceedings of a UMRCC symposium, 16-18 October 1995, St. Louis, Missouri. Upper Mississippi River Conservation Committee, Rock Island, Illinois.

Ahlstedt, S.A., M.T. Fagg, R.S. Butler, and J.F. Connell. 2005. Long-term trend information for freshwater mussel populations at twelve fixed-station monitoring sites in the Clinch and Powell rivers of Eastern Tennessee and Southwestern Virginia 1979-2004. Unpublished report to the U.S. Fish and Wildlife Service, Cookeville Field Office, February 16, 2005. 37 pp.

Allendorf, F.W. and G. Luikart. 2007. Conservation and the genetics of populations. Malden, Massachusetts, Blackwell Publishing. 642 pp.

Cicerello, R.R. 2005. Telephone interview. Kentucky State Nature Preserves Commission, Frankfort, Kentucky. Retired.

Davis, B., K. Moles, and J. Layzer. 2009. Unpublished data on the "reintroduction of mussels into the Little Tennessee River below Calderwood Dam." Tennessee Tech University, Cookeville, Tennessee. Presented to the Tennessee Chapter of the American Fisheries Society on March 4, 2009.

Dinkins, G. R. 2010. Assessment of native mussels in Indian Creek and North Fork Holston River. Prepared for The Nature Conservancy, Clinch Valley Program, Virginia Field Office, Abingdon, Virginia. 25 pp.

Gordon, M.E., and J.B. Layzer. 1989. Mussels (Bivalvia: Unionoidea) of the Cumberland River: review of life histories and ecological relationships. U.S. Fish and Wildlife Service Biological Report 89(15). 99 pp.

Hanlon, S. 2009. Email to Stephanie Chance on March 4, 2009. U.S. Fish and Wildlife Service. Abingdon, Virginia.

Hartfield, P., and E. Hartfield. 1996. Observations on the conglutinates of Ptychobranchus greeni (Conrad, 1834) (Mollusca: Bivalvia: Unionidea). American Midland Naturalist 135:370-375.

Hanlon, S.D., M.A. Petty, and R.J. Neves. In press. Status of native freshwater mussels in Copper Creek, Virginia.

Henley, W. F., R. J. Neves, L. L. Zimmerman, R. Winterringer. 1999. A survey of freshwater mussels in the Middle Fork Holston River, Virginia. Banisteria 14: 15-24.

Henley, W.F., J.W. Jones, J.L. Boyles, J.M. McLeod, and R.J. Neves. 2002. An evaluation of the suitability of the Cedar Bluff Spill Site for recovery of freshwater mussels, Clinch River, Tazewell County, Virginia. Final Report to the U.S. Fish and Wildlife Service, Gloucester, Virginia by the Virginia Cooperative Fish and Wildlife Research Unit, Virginia Polytechnic Institute and State University, Blacksburg, Virginia. 25 pp.

Hubbs, D. 2008. Unpublished data related to mussel translocations. Camden, Tennessee.

Johnson, M.S. 2008. Progress Report for 2008: Status of the freshwater mussel fauna in the Powell River, Virginia and Tennessee. Virginia Cooperative Fish & Wildlife Research Unit, Virginia Tech, Blacksburg, Virginia. 23 pp.

Jones, J.W., and R.J. Neves. 2007. Freshwater mussel status: Upper North Fork Holston River, Virginia. Northeastern Naturalist 14(3):471-480.

Kanehl, P., and J. Lyons. 1992. Impacts of in-stream sand and gravel mining on stream habitat and fish communities, including a survey on the Big Rib River, Marathon County, Wisconsin. Wisconsin Department of Natural Resources Research Report 155. 32 pp.

Kentucky Department of Fish and Wildlife Resources. 2005. Kentucky's Comprehensive Wildlife Conservation Strategy. KDFWR. Frankfort, Kentucky.

Kitchel, H.E., J.C. Widlak, and R.J. Neves. 1981. The impact of coal-mining waste on endangered mussel populations in the Powell River, Lee County, Virginia. Virginia State Water Control Board, Richmond. 26 pp.

Master, L.L., S.R. Flack, and B.A. Stein, eds. 1998. Rivers of life: critical watersheds for protecting freshwater biodiversity. The Nature Conservancy, Arlington, Virginia. 71 pp.

Moles, K.R., N.T. Welte, and J.B. Layzer. 2007. Mussel fauna of the Wolf River, Fentress and Pickett Counties, Tennessee. Journal of the Tennessee Academy of Science 82(3-4):77-82.

Neves, R.J. 1987. Recent die-offs of freshwater mussels in the United States: an overview. Pp. 7-18 *in*: R.J. Neves, ed. Proceedings of the workshop on die-offs of freshwater mussels in the United States, 23-25 June 1986, Davenport, Iowa. Virginia Polytechnic Institute and State University, Blacksburg, Virginia.

Neves, R.J. 1993. A state-of-the unionid address. Pp. 1-10 *in*: K.S. Cummings, A.C. Buchanan, and L.M. Koch, eds. Conservation and management of freshwater mussels. Proceedings of a UMRCC symposium, 12-14 October 1992, St. Louis, Missouri. Upper Mississippi River Conservation Committee, Rock Island, Illinois.

Neves, R.J., and M.C. Odom. 1989. Muskrat predation on endangered freshwater mussels in Virginia. Journal of Wildlife Management 53(4):934-941.

Neves, R.J., A.E. Bogan, J.D. Williams, S.A. Ahlstedt, and P.W. Hartfield. 1997. Status of aquatic mollusks in the southeastern United States: a downward spiral of diversity. Pp. 43-85 *in*: G.W. Benz and D.E. Collins, eds. Aquatic fauna in peril: the southeastern perspective. Special Publication 1, Southern Aquatic Research Institute, Chattanooga, Tennessee.

Ostby, B. K. 1995. Characterization of suitable habitats for freshwater mussels in the Clinch River, Virginia and Tennessee. Master's Thesis, Virginia Tech, Blacksburg, Virginia.

Osby, B.K., and R.J. Neves. 2005. Survey for endangered mussels at proposed Jewell Ridge Pipeline crossings of streams in southwest Virginia. Report to TRC Environmental Corporation, Lowell, Massachusetts. 15 pp.

Osby, B.K., and R.J. Neves. 2006a. Relocation of freshwater mussels from East Tennessee gas pipeline crossing of North Fork Holston River, Smyth County, Virginia. Report to TRC Environmental Corporation, Lowell, Massachusetts. 12 pp.

Osby, B.K., and R.J. Neves. 2006b. Supplemental relocation of freshwater mussels from East Tennessee gas pipeline crossing of North Fork Holston River, Smyth County, Virginia and assessment of sedimentation in habitat downstream of the crossing. Report to TRC Environmental Corporation, Lowell, Massachusetts. 14 pp.

Parmalee, P.W., and A.E. Bogan. 1998. The freshwater mussels of Tennessee. The University of Tennessee Press, Knoxville. 328 pp.

Petty, M., B. Ostby, and R.J. Neves. 2006. Freshwater mussel survey of Copper Creek, Virginia, and propagation of the federally endangered purple bean (Villosa perpurpurea). Report to the U. S. Fish and Wildlife Service, Abingdon, Virginia. 46 pp.

Shute, P.W., R.G. Biggins, and R.S. Butler. 1997. Management and conservation of rare aquatic resources: a historical perspective and recommendations for incorporating ecosystem management. Pp. 445-466 *in*: G.W. Benz and D.E. Collins, eds. Aquatic fauna in peril: the southeastern perspective. Special Publication 1, Southern Aquatic Research Institute, Chattanooga, Tennessee.

Soulé, M.E. 1980. Threshold for survival: maintaining fitness and evolutionary potential. Pp. 151-169 *in*: M.E. Soulé and B.A. Wilcox, eds. Conservation biology. Sinauer Associates, Inc., Sunderland, Massachusetts.

Tennessee Wildlife Resources Agency. 2005. Tennessee's Comprehensive Wildlife Conservation Strategy. TWRA. Nashville, Tennessee.

Tennessee Valley Authority. 1971. Stream length in the Tennessee River Basin. Tennessee Valley Authority, Knoxville, Tennessee. 25 pp.

Virginia Department of Game and Inland Fisheries. 2005. Virginia's Comprehensive Wildlife Conservation Strategy. Virginia Department of Game and Inland Fisheries. Richmond, Virginia. 717 pp. 16 Appendices.

Warren, M.L., and W.R. Haag. 2005. Spatio-temporal patterns of the decline of freshwater mussels in the Little South Fork Cumberland River, USA. Biodiversity and Conservation 14:1383-1400.

Wildlife and Freshwater Fisheries Division, Alabama Department of Conservation and Natural Resources. 2005. Conserving Alabama's wildlife: a comprehensive strategy. Alabama Department of Conservation and Natural Resources, Montgomery, Alabama. 322 pp.

Williams, J.D., M.L. Warren, Jr., K.S. Cummings, J.L. Harris, and R.J. Neves. 1993. Conservation status of freshwater mussels of the United States and Canada. Fisheries 18(9):6-22.

Winston, M.R., and R.J. Neves. 1997. Survey of the freshwater mussel fauna of unsurveyed streams of the Tennessee River drainage, Virginia. Banisteria 10:3-8.

APPROVAL/CONCURRENCE: Lead Regions must obtain written concurrence from all other Regions within the range of the species before recommending changes, including elevations or removals from candidate status and listing priority changes; the Regional Director must approve all such recommendations. The Director must concur on all resubmitted 12-month petition findings, additions or removal of species from candidate status, and listing priority changes.

Approve: _____ June 15, 2010
for Regional Director, Fish and Wildlife Service Date

Concur: _____ Date: October 22, 2010
ACTING
Director, Fish and Wildlife Service

Do Not Concur: _____ _____
Director, Fish and Wildlife Service Date

Director's Remarks:

Date of annual review: March, 2010
Conducted by: Stephanie Chance, Cookeville, TN Field Office